INSTRUCTIONS

RECLOSING RELAYS

TYPES HGA18M, HGA18N

GE Protection and Control
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CONTENTS

RECLOSING RELAYS

TYPES HGA18M, HGA18N

DESCRIPTION

The relays covered by these instructions are self-resetting, "single-shot" reclosing relays which are intended to initiate immediate reclosure of a power circuit breaker that has been tripped by protective relays. The relays will operate to initiate a reclosure following tripping of the breaker only if a predetermined time has elapsed since a previous successful reclosure.

These relays are designed for use where a single, immediate reclosure of circuit breakers is desired. In the event that the breaker reopens immediately after reclosure, indicating a continuation of abnormal conditions, the apparatus remains locked out. The relays are suited for use in applications where the requirements of continuity of service do not justify subsequent time reclosures, such as the Type NLR relays provide.

The Type HGA18M relay is designed for operation from a DC voltage source. The basic operating elements of this relay are a Type HGA hinged armature unit with a two-winding coil, a timing capacitor and two resistors. The Type HGA18N relay is similar in construction, but is intended for operation from an AC voltage source. It includes an externally mounted full-wave rectifier. Both relays include an indicating target in the output contact circuit. If the target indication is not desired, the target coil can be bypassed by means of an internal jumper.

The operation of these relays can best be explained with the aid of the typical external connection diagram in Figure 1, which applies to the HGA18M relay. With the associated circuit breaker closed, both auxiliary switches 52/b will be open, and the timing capacitor (79/CAP) will be charged to full rated DC voltage through the closed contact of 52/CS and the charging resistor. When the breaker trips, closure of the 52/b contact will discharge the capacitor through the operating coil (79/OC) of the HGA unit. That unit will then pick up and seal-in by means of its holding coil (79/HC), and will energize the breaker closing circuit via the output contact 79 between terminals 1 and 2 of the relay case.

When the breaker recloses, the 52/b contact will open, de-energizing the holding coil and causing the HGA unit to drop out. The timing capacitor will then commence to recharge. The reset time of the relay is defined as the time required for the capacitor to recharge to the point where its stored energy will be sufficient to pick up the HGA unit if the 52/b contact should again discharge the capacitor through the 79/OC coil. If the breaker remains closed for a time longer than the reset time, the relay will be ready to initiate a reclosure if the breaker is again tripped. However, if a subsequent opening of the breaker occurs in a time shorter than the reset time of the relay, the stored energy in the capacitor will not be sufficient to pick up the HGA unit and the reclosing relay will be locked out.

APPLICATION

The Type HGA18M and HGA18N reclosing relays are usually applied with transmission line circuit breakers where a single high-speed reclosure is desired, and if this single reclosure attempt is unsuccessful, it is desired to lock out the breaker. The external connections for such an application of the HGA18M relay are shown in Figure 1 where two 52/b contacts are available, or in Figure 2, when only one 52/b contact is available. Note in Figure 2 that when only a single 52/b contact is used, an external blocking diode is required to avoid a sneak circuit.

Typical external connections for the AC relay, Type HGA18N, are shown in Figure 3. Operation of the reclosing relay is initiated by a 52/b contact when the breaker opens, and reclosing of the breaker is by means of the indicated circuit breaker control device.

A capacitor discharge resistor is provided between terminals 6 and 9 of the relay case to provide a means of disabling the reclosing relay by use of an external contact if desired. For example, the user may wish to permit a reclosure following a high-speed pilot trip, but cancel reclosing following a delayed backup trip. This external reclose-cancel contact should be an electrically separate contact (i.e., "dry" contact) to avoid the possibility of a sneak circuit introduced by protective relay circuits.

When making the connections, it is important to note that the operating and holding coils produce flux in the same magnetic circuit. Therefore, the polarity of the connections to these coils, as shown in Figures 1, 2 and 3, must be observed.

GENERAL CONSIDERATIONS

The following general points must be considered when applying automatic reclosing relays:

Interrupting Rating of the Power Circuit Breaker

The derating factor applicable to the interrupting rating of the power circuit breaker should be checked prior to the application of a reclosing relay or the selection of a reclosing cycle.

Closing Control Circuits

When automatic reclosing is used, it is essential that the closing circuits with solenoid mechanisms ensure complete closure of the breaker, even though the auxiliary switch on the breaker mechanism opens before the closure is complete.

Latch-checking Switches

In order to ensure successful operation of a breaker being reclosed by a Type HGA18 relay, the breaker mechanism must be equipped with a latch-checking switch if the mechanism is trip-free. This switch ensures that the mechanism latch is properly set for reclosure before the closing circuit is completed. Latch-checking switches are not required for non-trip-free mechanisms.

Control Switches

A control switch (typically model 16SB1B9) should be provided with automatic reclosing schemes using the Type HGA18 reclosing relays. This switch includes contacts to prevent the breaker from being automatically reclosed after it has been tripped by the control switch. The breaker must be reclosed by means of the switch before the automatic reclosing feature will be restored.

Undervoltage Devices

Where undervoltage devices are involved on the circuit fed by the breaker, it is usually necessary to coordinate the reclosing time and the trip time of the undervoltage device to ensure that the desired results are obtained. Where the undervoltage device is involved in a throw-over scheme, the initial reclosure usually should be faster. Where motor control is involved, it may or may not be desirable for the initial reclosure to be faster. Each application should be checked to determine the required coordination.

Associated Protective Relays

If high-speed reclosing is to be successful, the protective relays that tripped the breaker obviously must reopen their contacts before the breaker recloses. Some of the superseded types of induction time-overcurrent relays are not suitable for use with high-speed reclosing.

If distance relays are supplied from line-side potential, their contacts should be supervised by the contacts of instantaneous fault detectors to ensure that the trip circuit is open before the breaker recloses.

CONSTRUCTION

The components of each relay are mounted on a cradle assembly that can be easily removed from the relay case. The cradle is locked in the case by means of latches at the top and bottom. The electrical connection between the case and cradle blocks is completed through removable connection plugs (see Figure 9). Separate testing plugs can be inserted in place of the connection plugs to permit testing the relay in its case. The cover is attached to the front of the case and includes two interlock arms which prevent the cover from being replaced until the connection plugs have been inserted.

The case is suitable for semiflush mounting on panels. Hardware is available for all panel thicknesses up to two inches; however, panel thickness must be specified when ordering the relay to ensure that the proper hardware will be provided. Outline and panel drilling dimensions are shown in Figures 10 and 11.

Contact circuits of the Type HGA relays are closed or opened by moving contact arms controlled by a hinge-type armature, which in turn is actuated by the operating coil and restrained by an adjustable control spring. The lengths of contact and armature gaps are adjusted by means of screw contacts and locknuts in the front fixed contact positions. Armature gap (and back contact wipe) can also be controlled by the screws and locknuts located on the moving contact arms. The latter features make it possible to reduce the pickup energy and pickup time to relatively low values. Only one normally-closed contact (not electrically

connected) is used, since the weak control spring tension would not give sufficient contact pressure on two normally-closed contacts. The coil consists of an operating and a holding winding which are connected in separate circuits. The holding winding is connected in series with a normally-open contact of the relay.

RATINGS

The Type HGA18M relay is available in 48, 125 or 250 volt DC ratings. The Type HGA18N relay is available for 115 or 230 volts AC (25-60 hertz) operation. Both types have reset times of 15 seconds.

CONTACTS

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The contacts have a current-carrying rating of 12 amperes continuously, or 30 amperes for one minute. Interruption ratings (non-inductive circuits) for various voltages are given in the table below.

TABLE I

	DC			AC
Volts	48	125	250	115
Amperes	1.5	0.6	0.25	20

TARGET

There are two ratings of target coils available. The choice between them depends on the current taken by the trip circuit. Also, the target can be disabled by moving one wire (see the internal connections).

The 0.2 ampere coils are for use with trip circuits that require currents ranging from 0.2 to 1.0 ampere at the minimum control voltage. If these coils are used in circuits that require 1.0 ampere or more, there is a possibility that the total resistance of the target circuit will limit the tripping current to so low a value that the breakers will not be tripped.

The 1.0 ampere coils should be used with trip circuits that take 1.0 ampere or more at the minimum control voltage. The current should not exceed 30 amperes at the maximum control voltage. If more than 30 amperes will flow, an auxiliary relay must be used to control the trip circuit. It should be connected in such a way that tripping current does not flow through the contact circuit of the HGA relay.

When one type of relay is to be adopted as standard to be used anywhere on a system, relays with the 1.0 ampere target and holding coil should be chosen. These relays should also be used where it is impossible to obtain trip-coil data. Attention is called to the fact that the target may not operate if used in conjunction with trip coils taking less than 1.0 ampere.

The ratings of the two forms of target coils are as shown in Table II.

TABLE II

	1.0 AMPERE AC TARGET	0.2 AMPERE AC TARGET
Minimum pickup (amperes)	1.0	0.2
Tripping duty (amperes)	30.0	5.0
Continuous duty (amperes)	2.5	0.4
DC resistance (ohms)	0.35	7.5
Impedance at 0.2 amperes (ohms)		
1) Armature open	0.41 + j0.42*	10.2 + j10.5
2) Armature closed	0.46 + j0.56*	11.5 + j11.5

*Calculated by $Z = \frac{N^2}{N'} Z'$

RECEIVING, HANDLING AND STORAGE

These relays, when not included as part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are damaged or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

ACCEPTANCE TESTS

GENERAL

The relay should be examined and tested upon delivery to ensure that no damage has been sustained in shipment and that the relay functions properly.

The following tests may be performed as part of the installation of the relay at the discretion of the user. Since most operating companies use different procedures for acceptance tests than for installation tests, the following section includes all applicable tests that may be performed on the relays.

VISUAL INSPECTION

Check the nameplate stamping to ensure that the model number and rating of the relay agree with the requisition.

Remove the relay from its case and check that there are no broken or cracked molded parts or other signs of physical damage, and that all the screws are tight.

MECHANICAL INSPECTION

The armatures of both the target unit and the HGA unit should move freely when operated by hand.

Check wiring against the proper internal connections diagram (Figures 4 and 5).

The contact wipe of the HGA unit, measured at the gap between the armature and the pole piece when the normally-open contacts just make, should be 0.02 inch. The minimum recommended contact gap is 1/16 inch.

CAUTION:

Every circuit in the drawout case has an auxiliary brush. It is especially important on current circuits, and other circuits with shorting bars, that the auxiliary brush be bent high enough to engage the connecting plug or test plug before the main brushes do. This will prevent current transformer secondary circuits from being opened. See Figure 9.

DRAWOUT RELAYS, GENERAL

Since all drawout relays in service operate in their cases, it is recommended that they be tested in their cases or an equivalent steel case. In this manner, any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a 12XLA13A test plug. This plug makes connections only with the relay and does not disturb any shorting bars in the case. The 12XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it also requires CT shorting jumpers and the exercise of greater care, since connections are made to both the relay and the external circuitry.

TIME CHECK

These relays are designed to close their contacts only if a predetermined time interval has elapsed since the previous contact closure. The time interval is determined by the time required to charge the capacitor to a high enough energy level to pick up the relay operating coil.

A test circuit for the Type HGA18 relay is shown in Figure 6.

Rated voltage should be applied to terminals 8 and 10 for all time checks, since the applied voltage has considerable effect on the time needed for the relay to reset.

Starting with zero charge on capacitor C, close switch S-2, starting the timer and charging capacitor C. When the timer indicates the resetting time, close S-1 and the relay should pick up. The timer will record the exact charging time.

If it is permissible to open the controlled circuit breaker momentarily, the relay resetting time may be determined by the "cut and try" method. That is, it should reclose the breaker immediately when it is first tripped, and again after waiting for the number of seconds equal to the "reset time" of the relay under test.

TARGET UNITS

Check that the target operates at 80% or less of its rating.

HOLDING COIL

Check the resistance of the holding coil with an ohmmeter. Holding coil resistance for relays rated 48 volts DC and below should be 270 ohms, ± 15%. The resistance of all other holding coils should be 7,250 ohms, ± 15%.

Check that the holding coil holds the armature closed after the relay is operated electrically.

INSTALLATION PROCEDURE

INTRODUCTION

The relay should be installed in a clean, dry location, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Figures 10 and 11. Figures 7 and 8 show outlines of the external rectifier and capacitor. These external devices are required when called for on the nameplate.

The internal connection diagrams for the relays are shown in Figures 4 and 5. Typical external connections diagrams are shown in Figures 1, 2 and 3.

ELECTRICAL TESTS AND SETTINGS

The section under **ACCEPTANCE TESTS** contains all necessary tests which may be performed as part of the installation procedure.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system, it is important that a periodic test program be followed. The interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements, it is suggested that the points listed under **ACCEPTANCE TESTS** be checked at an interval of from one to two years, or on the same schedule as the associated protective relays.

CONTACT CLEANING

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. The flexibility of the tool ensures the cleaning of the actual points of contact. Knives, files, abrasive paper or cloth of any kind should never be used to clean relay contacts.

SERVICING

Although the relay has been adjusted at the factory, a check may show that adjustments have been disturbed. The following adjustments can be made to restore the desired operation.

The contact wipe, measured by the gap between the armature and pole piece when the normally-open contacts just make, should be 0.02 inch. This gap may be obtained by means of the adjusting screws in the moving contact arms. Locknuts on these screws should be tightened after any adjustment.

Minimum recommended contact gap is 1/16 inch. This can be set by turning the right-hand contact screw in until the normally-open contacts are just making, backing it off 3-3/4 turns, and then locking it securely in position by means of the locknut. If the contact gaps are made shorter, the interrupting ratings listed no longer apply.

The resetting time of the relay is the time required for the capacitor to store sufficient energy to operate or pick up the relay unit. Steady-state DC voltage required to pick up the relay unit is considerably less than the capacitor voltage required. Control spring tension of the relay may be changed for slight adjustments of the resetting time. This is done by changing the position of the spring in the notches on the armature tail, or by shifting it from one hole to the other of the anchor pin. If it is not possible to increase reset time to 15 seconds by adjusting the spring, it is permissible to increase the armature gap by means of the back contact until the required charging time is obtained. The contact gap in this case will be approximately 1/8 inch.

The charging resistor, R1, and capacitor were selected to provide the normal resetting time at rated voltage; however, longer or shorter resetting time may be obtained by changing the values of these components. For longer times change the capacitor; for shorter times, change the resistor. The new value of resistance or capacitance may be selected using the following formulae:

$$R1A = \frac{T_2}{T_1} R1$$

and

$$C_2 = \frac{C_1}{T_1} (T_2 - T_1)$$

where:

$R1$ = resistance (in ohms) in relay as shipped

$R1A$ = resistance (in ohms) required for desired resetting time

T_1 = rated resetting time (in seconds) of relay

T_2 = desired resetting time (in seconds)

C_1 = capacitance in microfarads in relay as shipped

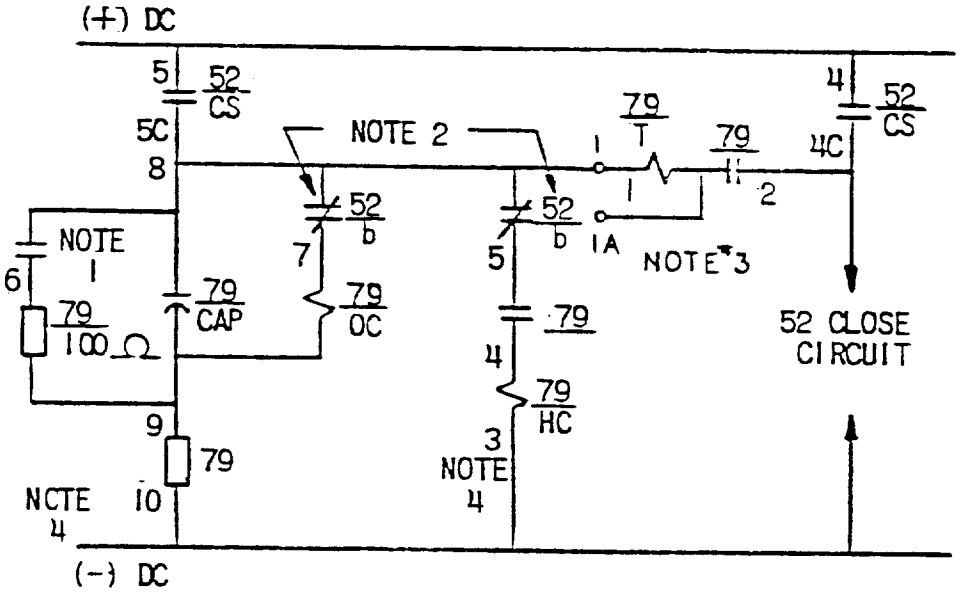
C_2 = added capacitance in microfarads across terminals 8 and 9.

RENEWAL PARTS

Sufficient quantities of renewal parts should be kept in stock for the prompt replacement of any that are worn, broken or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company. Specify the name of the part wanted, quantity required, and complete nameplate data, including the model number of the relay.

Since the last edition, Figures 10 and 11 have been revised.



52/CS 16SBIB9		CLOSE	NOR AFT CLOSE	NCR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

INTERNAL

79 - HGA18M 0285A5704

OC - OPERATE COIL

HC - HOLDING COIL

T - TARGET

CAP - CAPACITOR

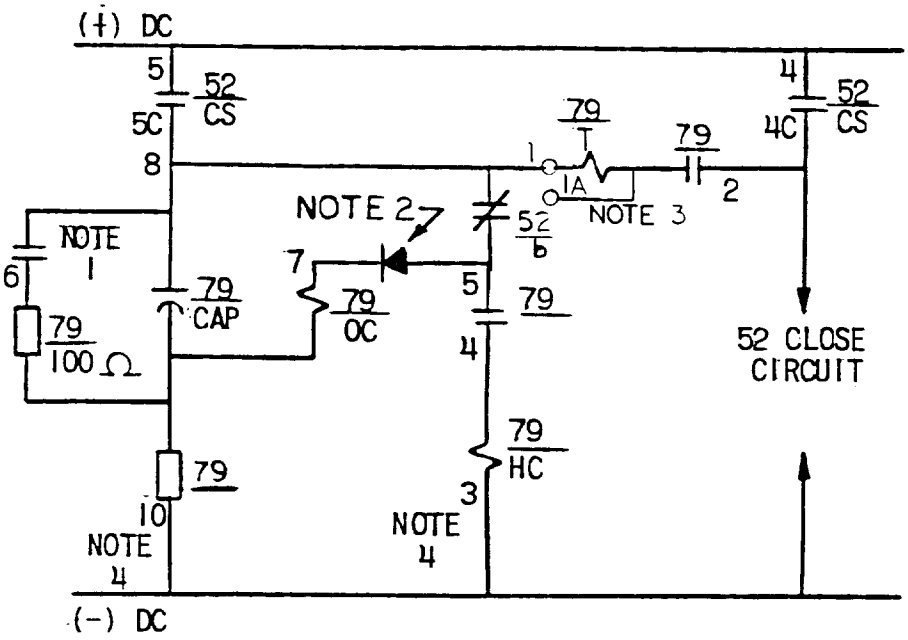
NOTE 1: DISABLING CONTACT, TO BE SUPPLIED BY USER.

NOTE 2: TWO BREAKER b SWITCHES ARE NECESSARY TO AVOID A SNEAK CIRCUIT. WHEN ONLY ONE b SWITCH IS AVAILABLE, SEE DRAWING 0285A6287

NOTE 3: IF TARGET OPERATION IS NOT DESIRED, SHIFT INT. JUMPER FROM 1A TO 1.

NOTE 4: TERMINALS 3 AND 10 MUST BE OF SAME D-C POLARITY.

Figure 1 (0285A6286-0) Typical External Connections of Type HGA18M Relay Where Two 52/b Contacts are Available



52/CS 16SBIB9		CLOSE	NOR AFT CLOSE	NOR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

INTERNAL

79 - HGA18M 0285A5704

OC - OPERATING COIL
HC - HOLDING COIL
T - TARGET
CAP - CAPACITOR
RECTIFIER 295B233
GI2 48 OR 125V DC
GI3 250V DC

NOTE 1: DISABLING CONTACT, TO BE SUPPLIED BY USER.

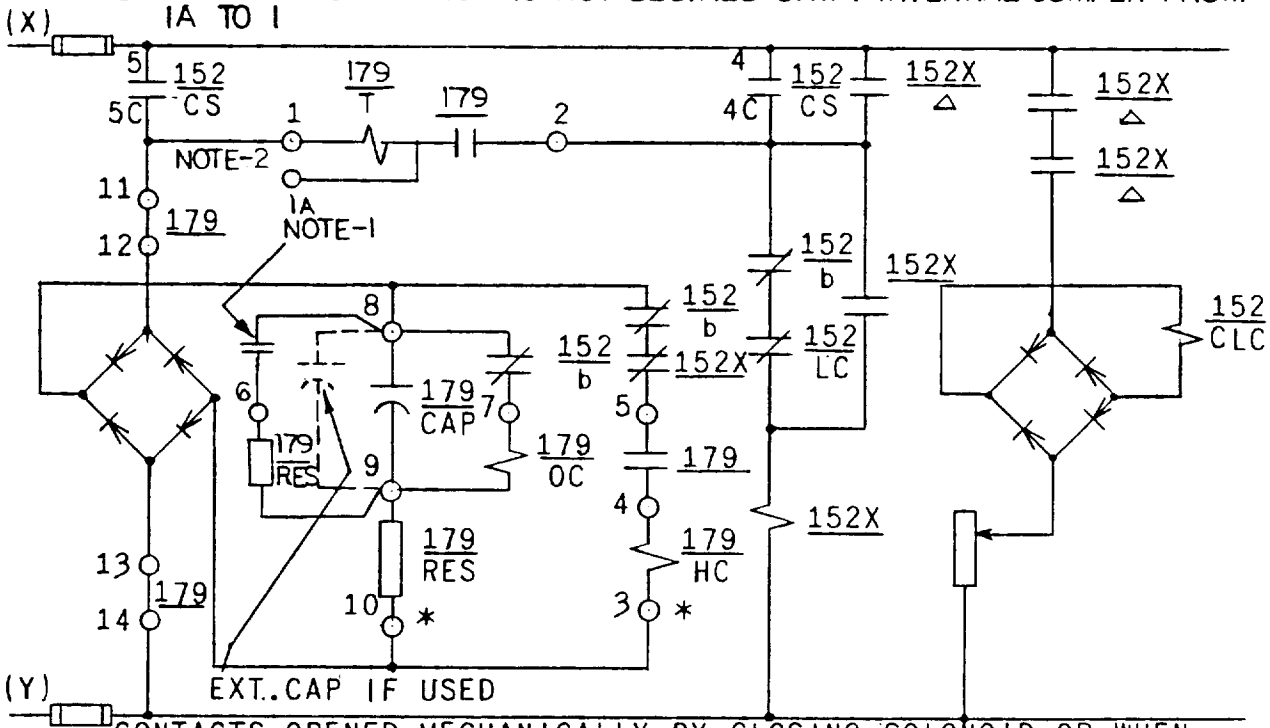
NOTE 2: RECTIFIER IS NECESSARY TO AVOID SNEAK CIRCUIT WHEN USING ONE BREAKER b SWITCH FOR INITIATION. SEE ALSO DRAWING 0285A6286

NOTE 3: IF TARGET OPERATION IS NOT DESIRED SHIFT INTERNAL JUMPER FROM 1A TO 1.

NOTE 4: TERMINALS 3 AND 10 MUST BE OF SAME D-C POLARITY.

Figure 2 (0285A6287-0) Typical External Connections of Type HGA18M Relay using One 52/b Contact and a Blocking Diode

NOTE 1: DISABLING CONTACT, TO BE SUPPLIED BY USER
NOTE 2: IF TARGET OPERATION IS NOT DESIRED SHIFT INTERNAL JUMPER FROM 1A TO 1



△ CONTACTS OPENED MECHANICALLY BY CLOSING SOLONOID OR WHEN 152X IS DE-ENERGIZED.

CONTACTS HANDLE END		CLOSE	NORM. AFTER CLOSE	NORM. AFTER TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

CONTROL SWITCH (152CS) MODEL 16SB1B9- SPRING RETURN TO NORMAL- X DENOTES CONTACT CLOSED- CONTACTS SHOWN IN NORMAL AFTER CLOSE POSITION.

LEGEND		
SYMBOL	DEVICE	DESCRIPTION
152		CIRCUIT BREAKER
152CLC		CIRCUIT BREAKER CLOSING COIL
152b		CIRCUIT BREAKER AUXILIARY SWITCH
152CS	16SB1B9	CIRCUIT BREAKER CONTROL SWITCH
152LC		CIRCUIT BREAKER LATCH CHECKING SWITCH
152X	K-6375988	CIRCUIT BREAKER CONTROL DEVICE
179	HGA18N	RECLOSING RELAY
179 CAP		RECLOSING RELAY CAPACITOR
179HC		RECLOSING RELAY HOLDING COIL
179 OC		RECLOSING RELAY OPERATING COIL
179 RES		RECLOSING RELAY CHARGING RESISTOR
179T		RECLOSING RELAY TARGET

* = TERMINALS 3 AND 10 MUST BE OF THE SAME POLARITY.

Figure 3 (0285A6288-0) Typical External Connections for Type HGA18N Relay

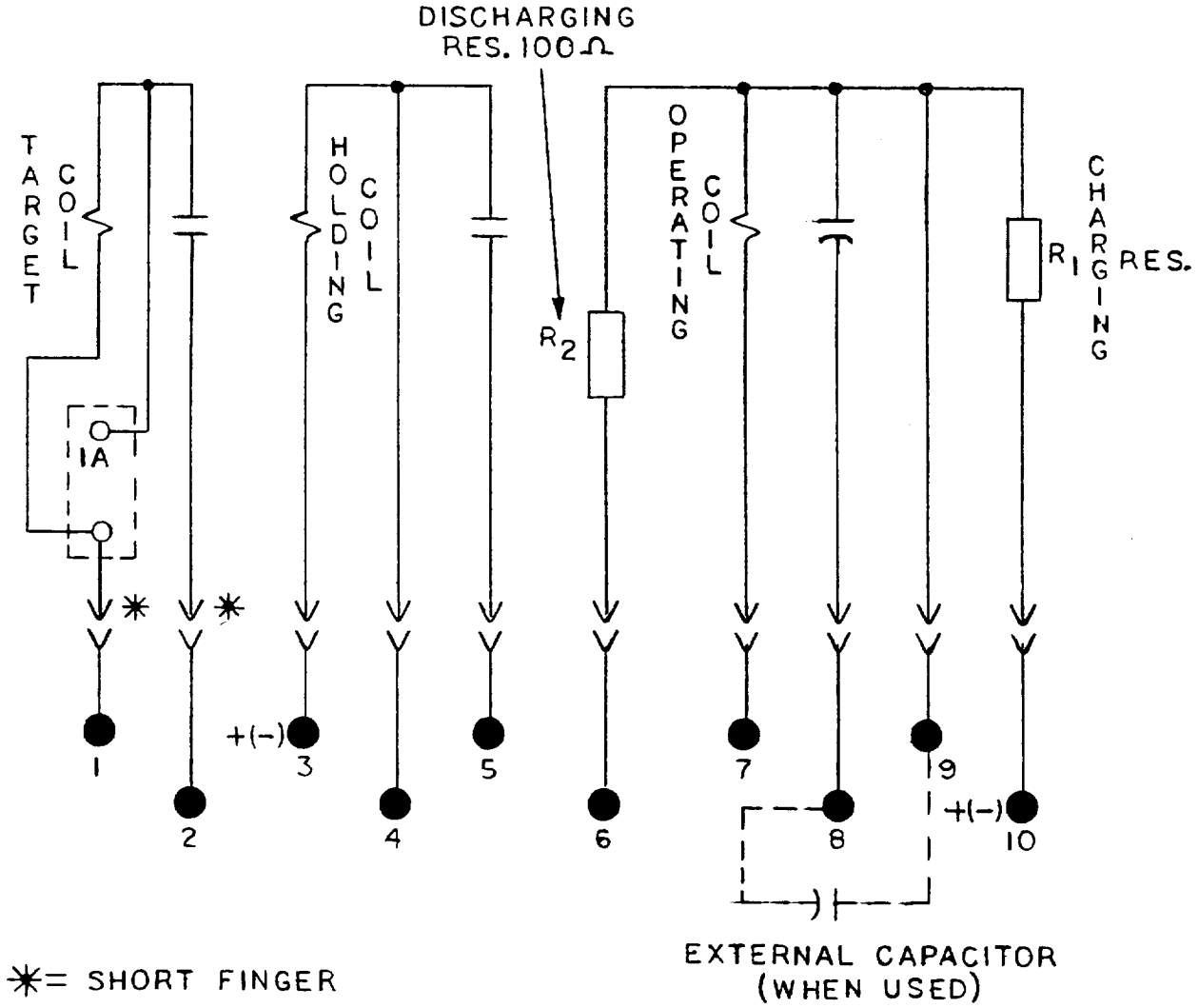


Figure 4 (0285A5704-0) Internal Connections Diagram for Type HGA18M Relay (Front View)

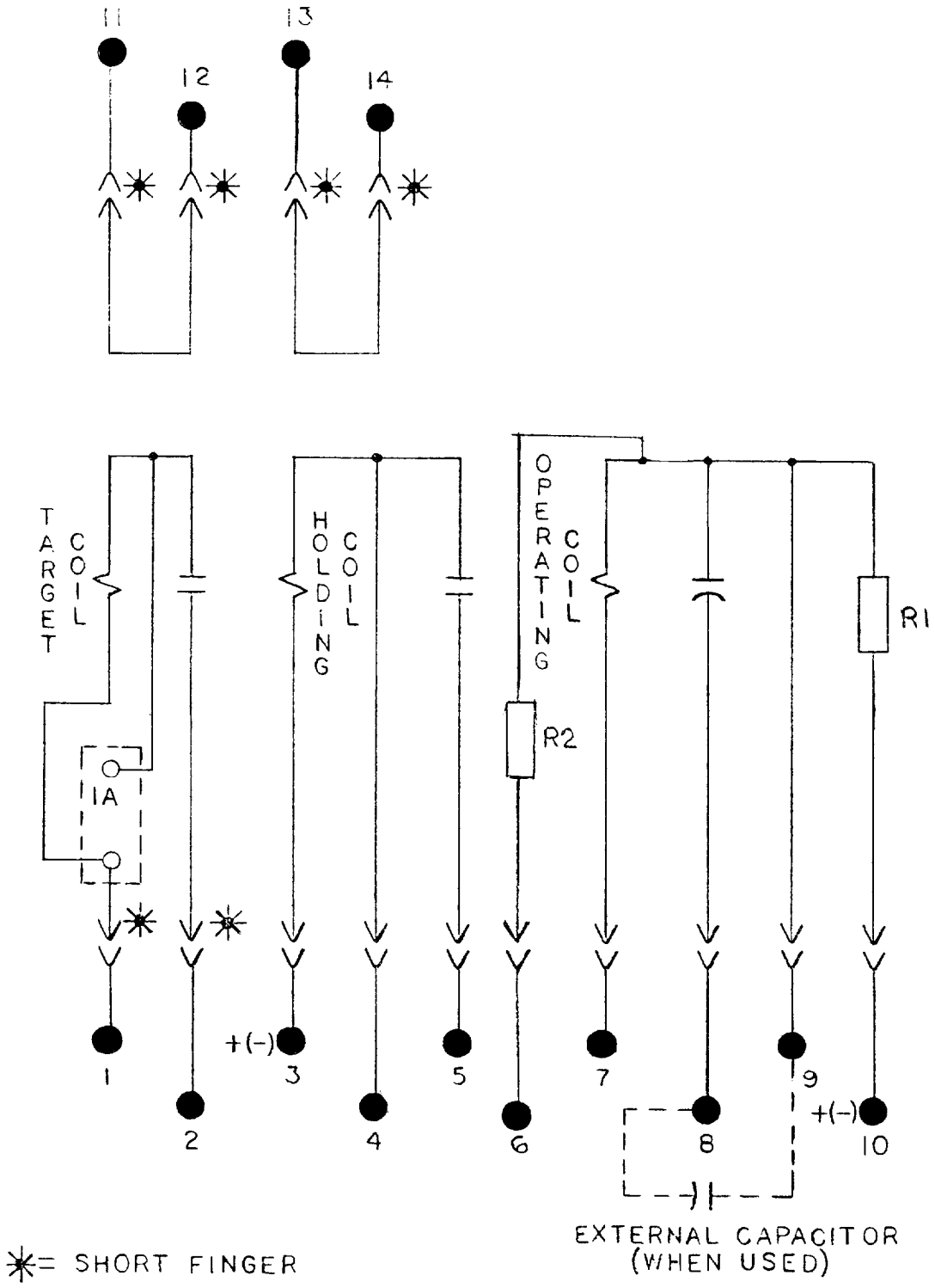
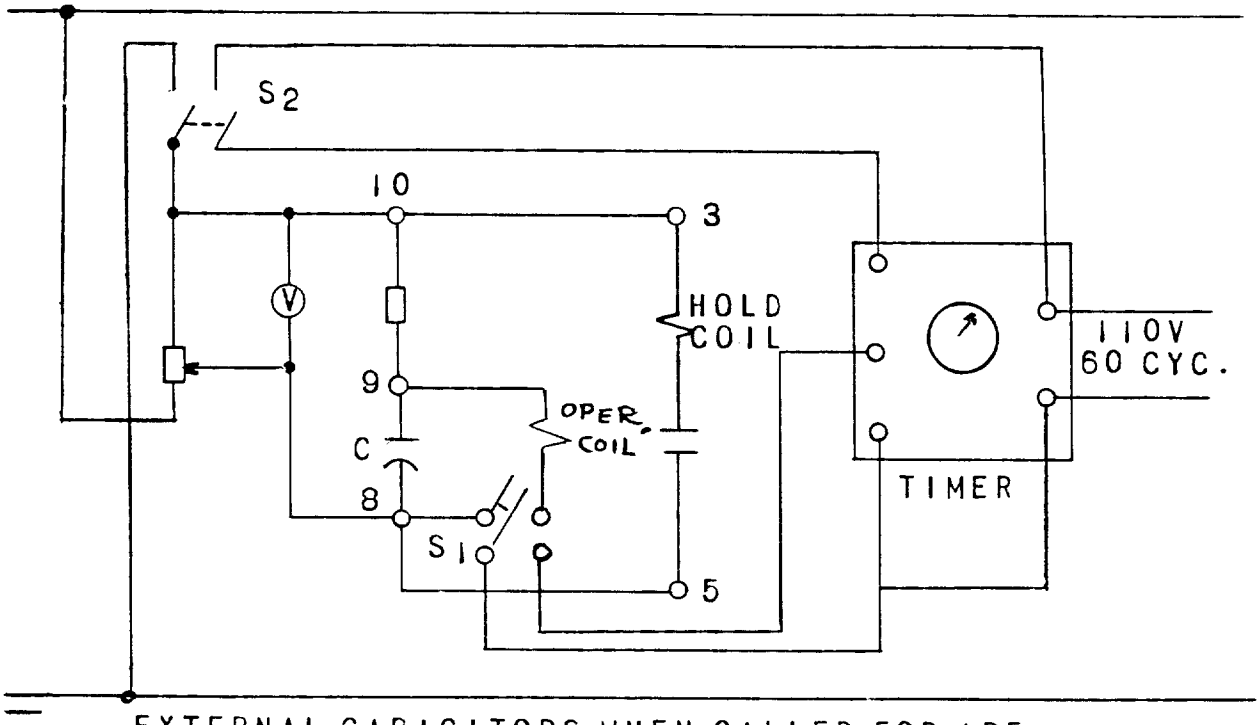
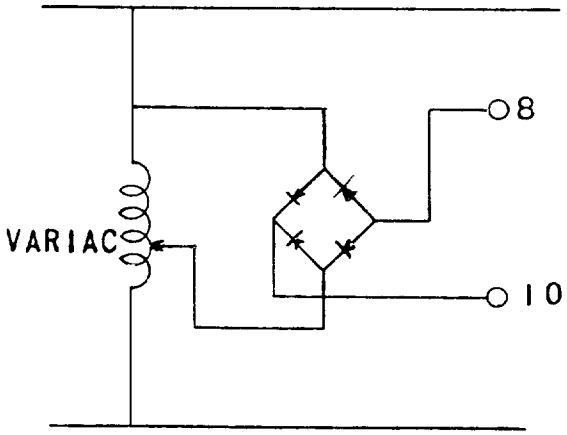


Figure 5 (0285A5705-1) Internal Connections Diagram for Type HGA18N Relay (Front View)



EXTERNAL CAPACITORS WHEN CALLED FOR ARE CONNECTED BETWEEN STUDS 8 AND 9.



FOR FULL WAVE RECTIFIED SOURCE OTHERWISE SAME AS ABOVE FIGURE.

Figure 6 (6400546-4) Testing Connections for Type HGA18M and HGA18N Relays

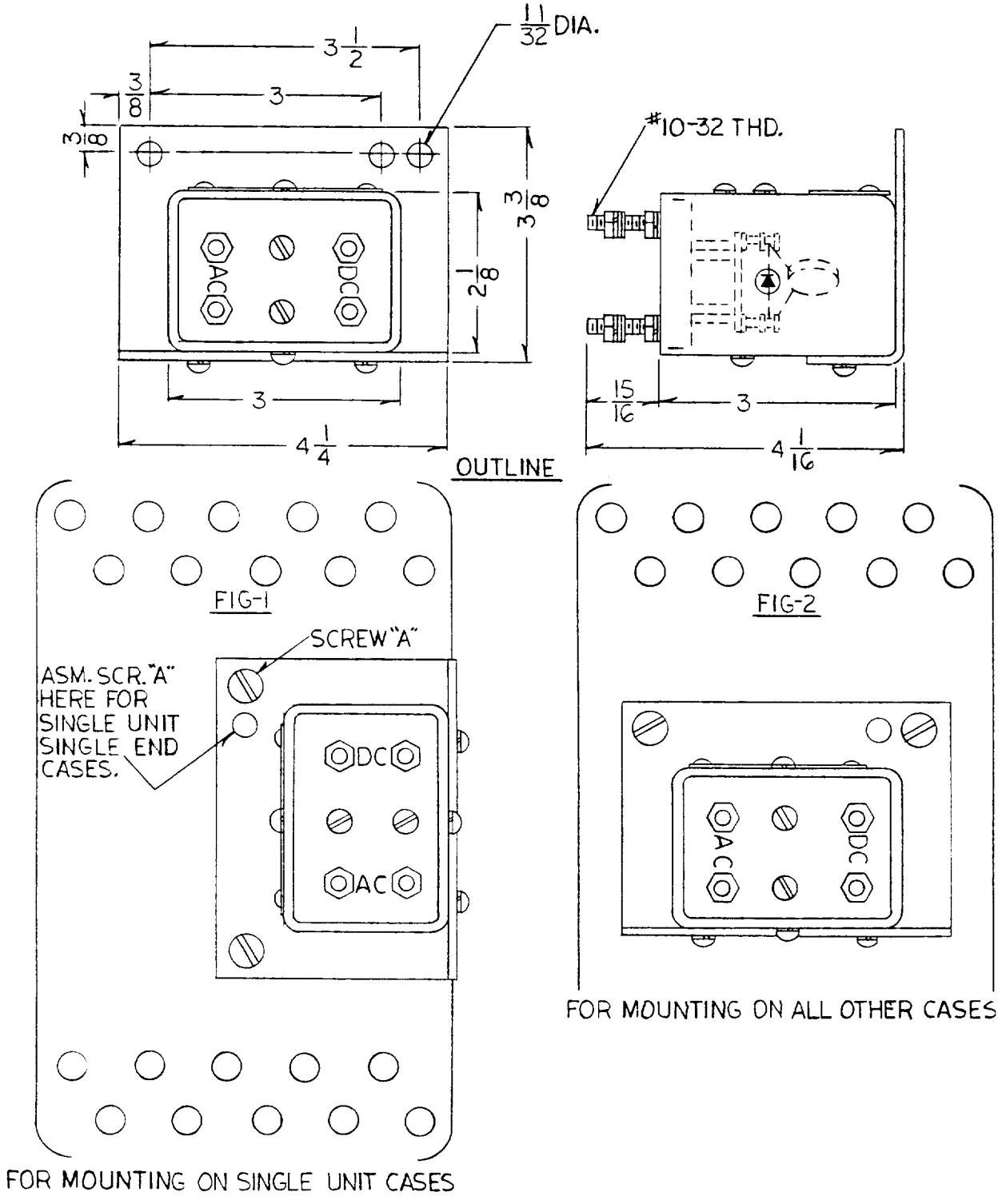
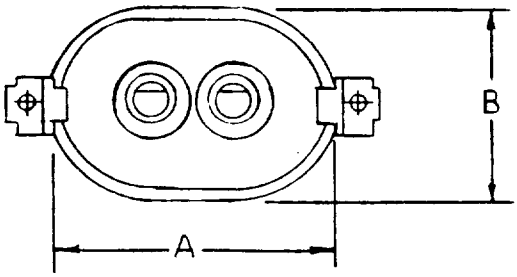
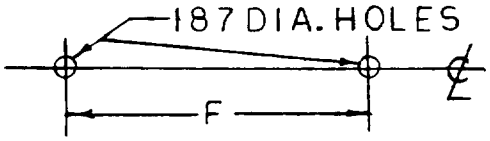


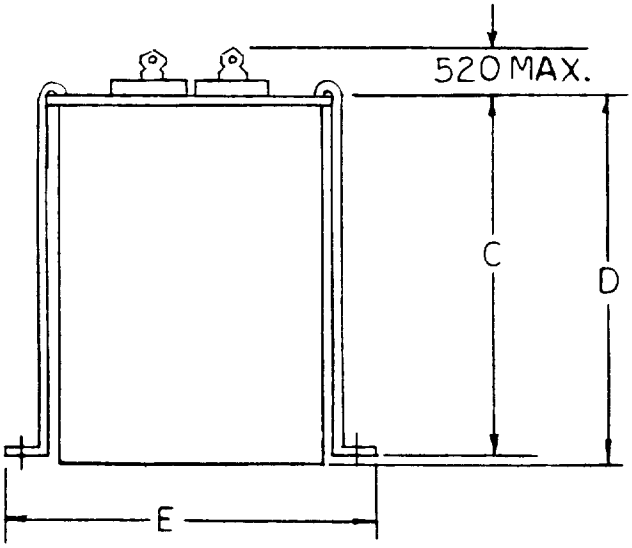
Figure 7 (0246A6996-0) External Rectifier Outline and Panel Drilling for Type HGA18N Relay



PLAN VIEW



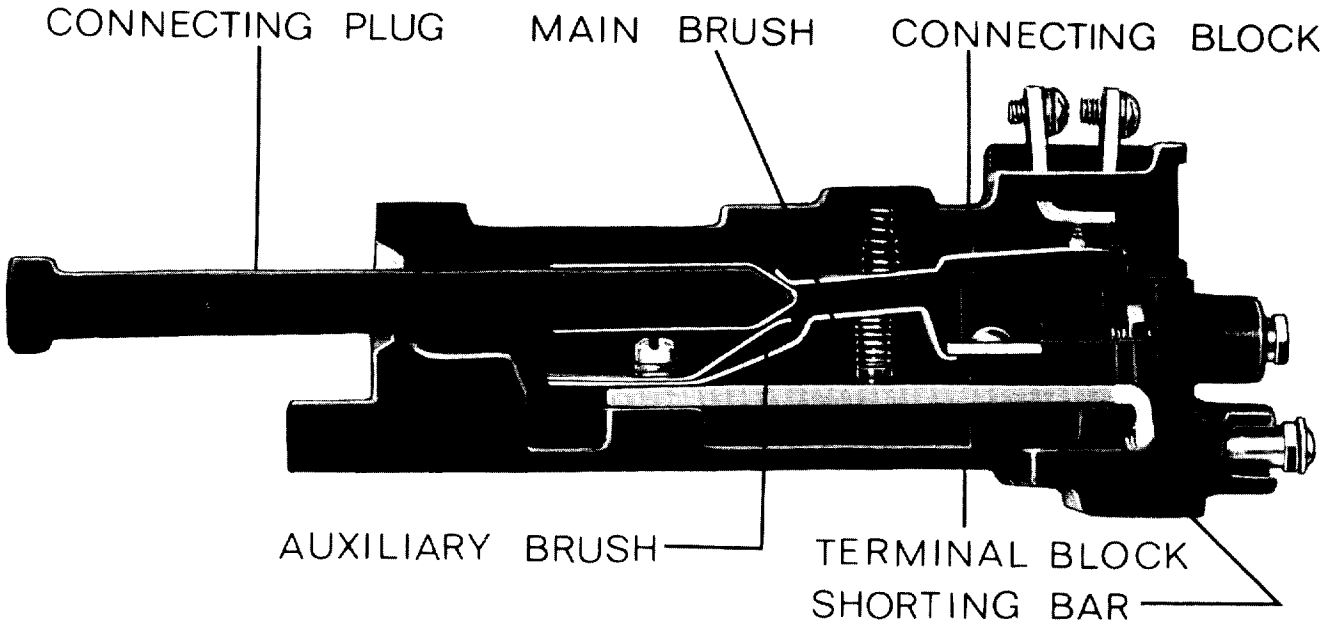
DRILLING PLAN



FRONT VIEW

CAPACITOR 0246A9024		BRACKET 0302C0920	DIMENSIONS					
PART NO.	μf	PART NO.	A	B	C	D	E	F
0250A	2.5	210	2.16	1.31	2.016	2.12	3.000	2.562
0300A	3.0	210	2.16	1.31	2.016	2.12	3.000	2.562
0400A	4.0	205	2.16	1.31	3.391	3.50	3.000	2.562
0500A	5.0	178	2.16	1.31	2.672	2.88	3.000	2.562
0600A	6.0	115	2.91	1.91	3.750	3.88	3.812	3.375
0750A	7.5	178	2.91	1.91	2.672	2.88	3.812	3.375
0800A	8.0	179	2.91	1.91	3.016	3.12	3.812	3.375
1000A	10	115	2.91	1.91	3.750	3.88	3.812	3.375
1200A	12	122	2.91	1.91	4.125	4.25	3.812	3.375
1500A	15	122	3.66	1.97	4.125	4.25	4.562	4.125
2500A	25	213	3.66	1.97	6.641	6.75	4.562	4.125

Figure 8 (0285A6143-0) External Capacitor for Type HGA18 Relays



NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Figure 9 (8025039) Drawout Case Contact Assembly Cut-away

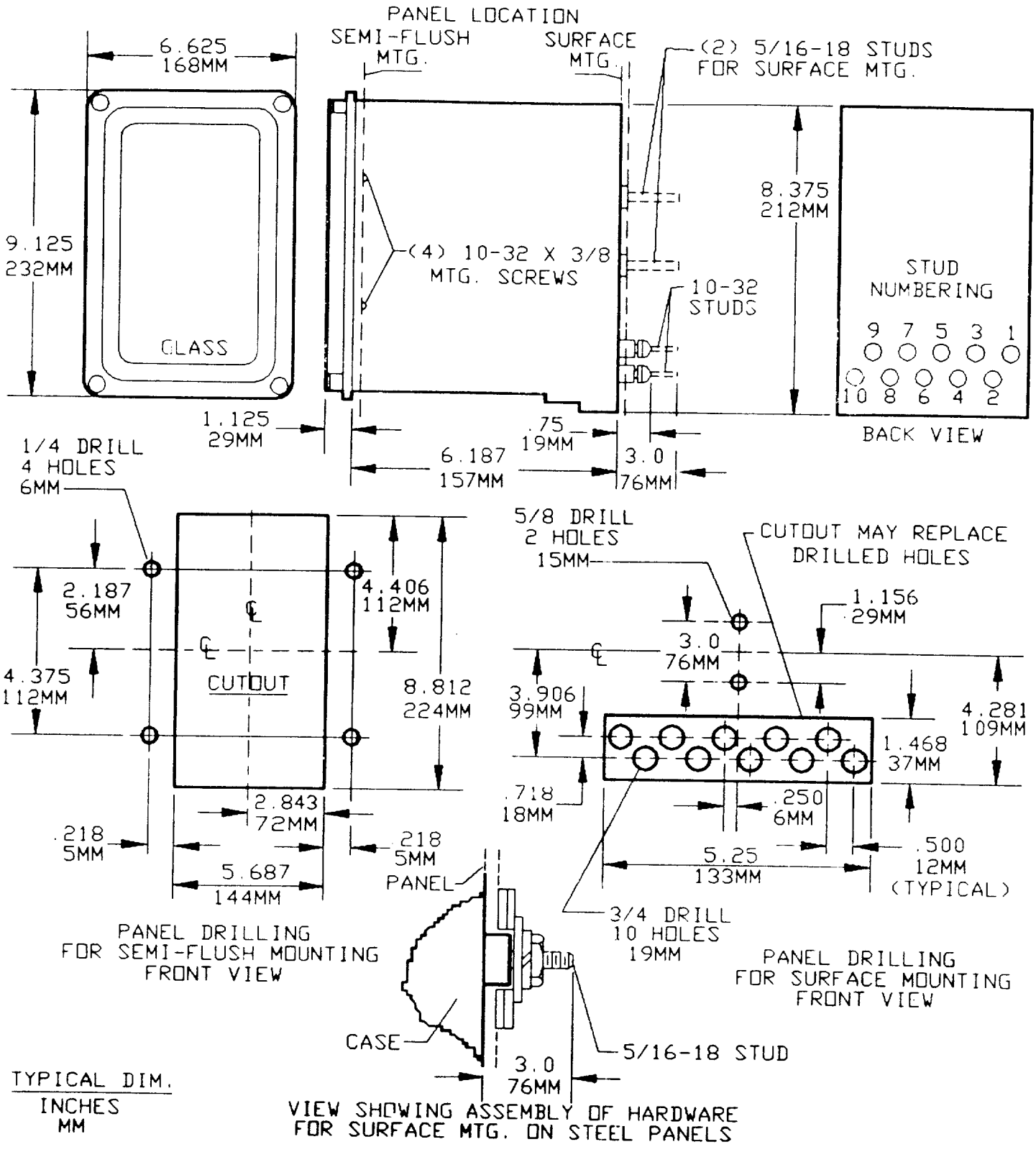


Figure 10 (6209271 [8]) Outline and Panel Drilling Dimensions for Type HGA18M Relay

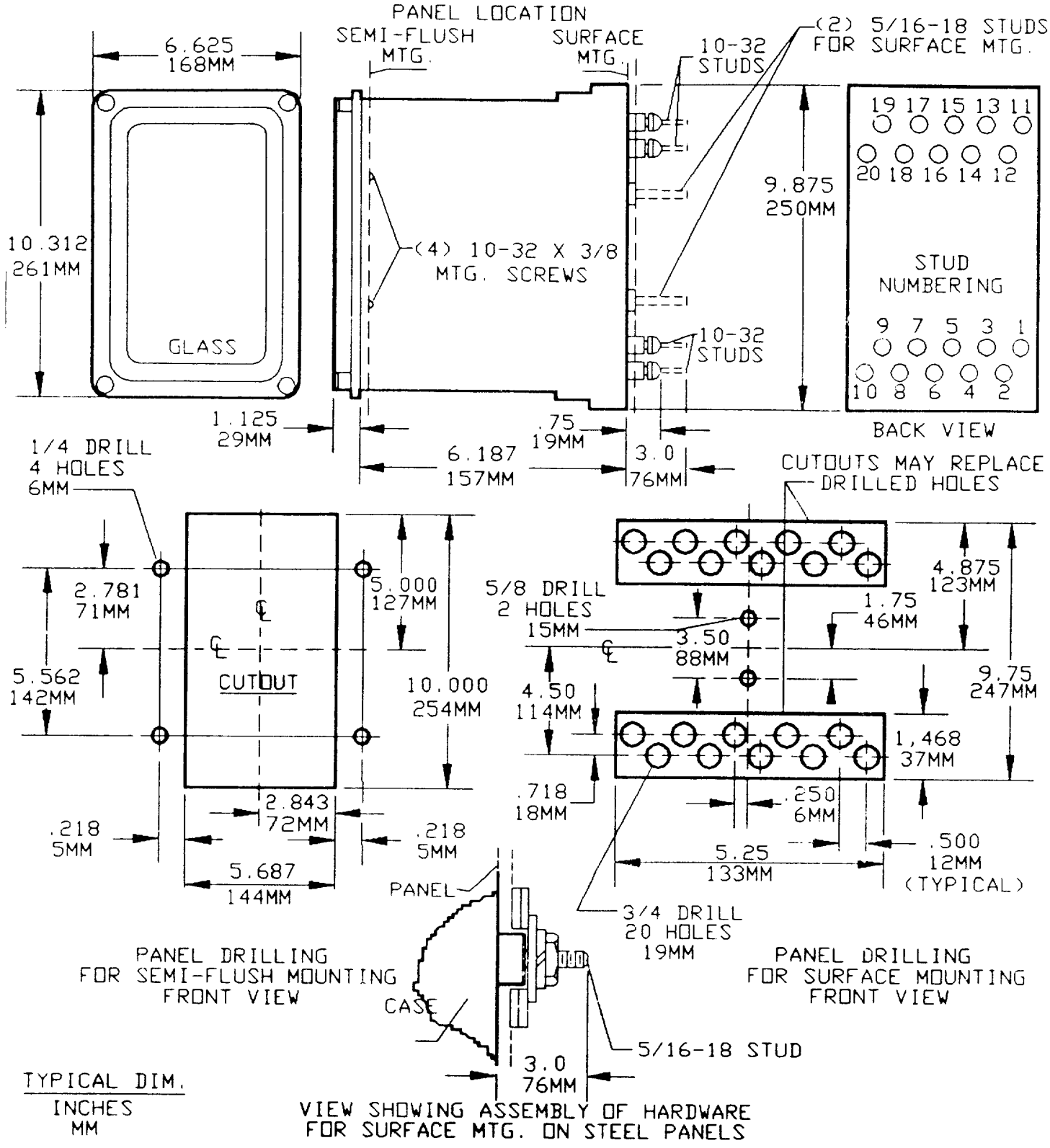


Figure 11 (6209272 [7]) Outline and Panel Drilling Dimensions for Type HGA18N Relay

Protection and Control

(8/94) (400)

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